"Synthesis, Characterization and Photochromic Study of Schiff Base Pyrazolone Derivatives"

Introduction

Photochromism is defined as reversible transformation of a single chemical species between two states having distinguishably different absorption spectrum, which is brought about by the action of electromagnetic radiation in at least one direction. Photochromism has received considerable attention during last few decades [1]. The photochromic properties associated with fascinating class of organic molecules has suggested a wealth of potential applications in a wide diversity of area, ranging from biomedical research to information technology. Indeed, some of these compounds have evolved into convenient building blocks for the fabrication of commercial ophthalmic lenses. Taking in regard, the large numbers of important applications, designing a novel class of photochromic material and evaluation of its photochromic properties emerges as an interesting class of fundamental yet immensely applicable research.

Literature survey

Research and development in material chemistry has contributed significantly for advance applications in the field of nuclear, space, defense, health, aviation and transport. It provides both opportunities and challenges to the researchers in the field of chemistry and material chemistry. Photochromic organic materials are interesting not only in designing new materials for optical data processing and storage, but also because the photo induced molecular transformations which might be used to gain control over other physical properties in the solid state.

Photochromism in organic system is a phenomenon entailing the reversible change of a selected chemical species from one molecular conformation to another [2-3]. The development of photochromic materials has been an area of intense research in recent years because of their potential applications, such as high-density optical storage media, nonlinear-optical materials and molecular switching device etc [4-7]. Lots of work on spiropyrans, spiroxazine, dithienylethenes, fulgides have been extensively reported [8] in the field of photochromism but scanty of work is carried out for Schiff bas pyrazolone derivatives. Pyrazolones and their derivatives are widely used in biological applications [9-10], but little information is available on their photochromic properties.

Photochromic molecules comprise one subset of the broad family of stimuli-responsive materials whereby multiple external stimuli can lead to defined alterations of properties materials. For the practical application of photochromic switches, several attempts have recently been made to modulate the photochromic properties [11]. For the tuning of spectral properties for further application, coordination with metal cation and ligands is promising method. The detection of precious metal ions with use of ligands has attracted the interest of analysts [12] and its recognition has developed rapidly because

these metal ions are valuable and rare. Such metals are very important for many industrial processes and products. Despite the importance of these metals in such fields, a major problem is the subsequent pollution of the environment that comes with their frequent use. Accordingly, the recognition and sensing of these metal ions with use of photochromic Schiff base has also been an especially active research area [13-14].

Objective of the work

In view of all the importance and application of Photochromism, here we put forward within this direction and attempt to develop such kind of materials. From the literature survey many compounds exhibit photochromic properties with different chemical process. The present work aims to find new candidates of photochromic material *(Schiff base pyrazolone compounds)* and find their applications. Further the photochromic mechanisms of Schiff base pyrazolone compounds in solid as well as in solution state could be studied. The kinetic behavior have also been examined.

The thesis is divided into seven chapters

The aim of present work is to synthesise and characterize Schiff base pyrazolone derivatives and to investigate their photochromic properties and its applications.

Chapter-1: Introduction and Literature Review

This Chapter covers the useful information on the photochromism and different class photochromic compounds. Literature studies on the different photochromic families and their mechanism have been reported. The suitability of the Schiff base pyrazolone compounds for photochromic ability is presented. It contains brief objective and scope of the present work.

Chapter-2: Experimental

This chapter describes the synthesis of 1-phenyl-3-methyl-4-formyl-5-pyrazolone (PMFP), 1-phenyl-3-methyl-4-acyl-5-pyrazolone (PMAP), and1-phenyl-3-methyl-4-benzyl-5-pyrazolone (PMBP), pyrazolone derivatives using 1-phenyl-3-methyl-5-pyrazolone. The corresponding Schiff bases have been synthesised with each of above pyrazolone derivatives using five amines (i) 2-amino-1-methyl benzene (ii) Naphthalene-1-amine (iii) Antheacen-2-amine (iv) 4-(phenyldiazenyl) aniline (v) 4-amino-1,5 dimethyl-2-phenyl-1,2-dihydro-3H-pyrazol-3-one. The experimental methods for determination of kinetic study have been reported.

Chapter-3: Spectral Analysis

This chapter deals with the spectral characterization of the Schiff base pyrazolone derivatives. Different instrumental technique like FT-IR, ^{1}H-NMR, ^{13}C-NMR, LC-MS and UV-Vis. spectrophotometer were used.

Chapter-4: Photochromic Study

It describes the comparison of photochromic ability of Schiff base pyrazolone derivatives using UV-Vis. reflectance spectra.

Chapter-5: Single Crystal Study

The single crystal studies have been performed using X-ray diffraction. The crystallographic study were describes for some representative compounds which suggests the photochromic mechanism.

Chapter-6: Results and Discussion

This chapter comprises the discussion on the results of kinetics, mechanism and chromic studied.

Chapter-7: Applications

This chapter describes the utilization of present Schiff base pyrazolone derivatives as metal ion sensing materials and its future use as logic gates or molecular switches.

Conclusion:

The results and discussion is followed by the concluding remarks derived from this research work.

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